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Using GWP* to bring short-lived pollutants into a carbon budget or to evaluate NDCs of the Paris Agreement

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Short lived climate pollutants (SLCPs) cannot be brought into a carbon budget framework using the most common method for calculating CO_2-equivalence (Global Warming Potential over 100 years, GWP_{100}). This is because a unit emission of CO_2e calculated using GWP_{100} will generate a different warming profile over time for each different short-lived pollutant, which is different to the warming profile of the CO_2 that it is nominally equivalent to.

Furthermore, sustained emission rates of SLCPs will result in an equilibrium where emissions are balanced by atmospheric removal, resulting in stable atmospheric concentrations. In contrast, sustained emissions of long-lived climate pollutants will lead to rising concentrations. The way in which the two types of climate pollutant would contribute to a cumulative carbon budget is therefore fundamentally different.

A modified usage of GWP_{100}, called GWP* (Allen et al., 2018), takes into account the distinct impacts of short-lived pollutants by equating a sustained change in SLCP emission rate with a one-off pulse emission of CO_2. (GWP is usually used to compare two pulse emissions.) A unit emission of CO_2e* generated using GWP* provides a much better approximation of the resultant warming compared to using conventional CO_2e, and therefore can be used to bring SLCPs like methane into a carbon budget. This would allow Nationally Determined Contributions from the Paris Agreement for all greenhouse gases to be aggregated and combined with TCRE (Transient Climate Response to Cumulative CO_2 Emissions) in order to measure and monitor progress towards the Paris Agreement's long-term temperature goal.

The transparency framework of the Paris Agreement currently requires the use of GWP_{100} but does not limit countries to reporting only a single number. If countries provide only a single number of aggregate CO_2e emissions using GWP_{100}, analysis of the impact of their emissions on warming is unnecessarily ambiguous. The simplest solution is for countries to report two numbers, separating cumulative and short-lived climate pollutants, expressing both as aggregate CO_2e using GWP_{100} following the COP24 decision. This would allow the calculation of aggregate emissions using GWP* in addition to the conventional calculation, substantially reducing uncertainty in the resulting warming.

Allen, M. R., Shine, K. P., Fuglestvedt, J. S., Millar, R. J., Cain, M., Frame, D. J., & Macey, A. H. (2018). A solution to the misrepresentations of CO_2-equivalent emissions of short-lived climate pollutants under ambitious mitigation. *Npj Climate and Atmospheric Science*, 1(1), 16. https://doi.org/10.1038/s41612-018-0026-8